

## STANDOFF LAND-ATTACK MISSILE EXPANDED RESPONSE (SLAM ER)



### Navy ACAT II Program

Total Number of Systems:	700
Total Program Cost (TY\$):	\$525M
Average Unit Cost (TY\$):	\$500K
Full-rate production:	3QFY00

### Prime Contractor

Boeing

### SYSTEM DESCRIPTION & CONTRIBUTION TO JOINT VISION 2020

The Standoff Land-Attack Missile- Expanded Response (SLAM-ER) is a precision tactical weapon for deployment aboard aircraft carriers and is launched from an F/A-18 aircraft. SLAM-ER is designed to provide standoff precision strike against fixed, high value land targets; secondary targets include relocatable stationary land targets and ships. It should satisfy intermediate tactical needs between long-range cruise missiles and short-range free fall munitions. The improvements provided by SLAM-ER over its predecessor, SLAM, take advantage of new technological innovations to provide naval tactical aircraft with the tools required for *precision engagement*. These improvements include: (1) longer range to increase survivability of launch and/or control aircraft; (2) reduced susceptibility to countermeasures; (3) increased probability of kill against hardened targets for increased system lethality;

(4) an improved guidance navigation unit with an integrated Global Positioning System and Inertial Navigation System; and (5) improved user interfaces for mission planning, launch and control aircraft.

## **BACKGROUND INFORMATION**

Baseline SLAM is a fielded system with proven combat performance in Operation Desert Storm and Bosnia, while SLAM-ER is intended to provide incremental improvements in range and penetrating lethality. SLAM-ER entered EMD after a Milestone IV/II decision in 2QFY95. In December 1996, the Assistant Secretary of the Navy (RDA) decided to procure the FY96 buy of SLAM in the SLAM-ER configuration avoiding \$35 million in future retrofit costs. The LRIP I decision was made in April 1997 with LRIP II made in April 1998 and LRIP III made in August 1999. These three production decisions totaled over 100 missiles. Milestone III and the full-rate production decisions were approved in May 2000.

Since SLAM-ER uses a newly developed titanium-cased warhead instead of the Harpoon warhead used in SLAM, LFT&E was required. The LFT&E strategy in the 1996 OSD-approved TEMP specified three data sources for LFT&E: (1) confined volume testing at the Nevada Test Site (completed in early FY97); (2) three arena tests of warhead fragmentation (completed in FY98); and (3) four sled tests of warhead penetration (completed in FY98). The FY00 LFT&E activity against the ex-USS Dale finished the assessment of previously completed test results, and the preparation of the Director's Live Fire Lethality Assessment.

## **TEST & EVALUATION ACTIVITY**

IOT&E was conducted from May 1998-May 1999. OT-IIA Phase I was conducted as combined DT/OT and three pre-production representative missiles were tested in captive carry mode and subsequently launched at threat representative targets. Phase I testing was conducted for risk reduction before proceeding to OPEVAL; specifically to assess the integration of SLAM-ER on the F/A-18 aircraft and to assess the performance of the SLAM-ER mission planning module on TAMPs. Applicable operational data from Phase I was combined with OT-IIA Phase II data to arrive at final operational test results.

OT-IIA Phase II (OPEVAL) was conducted from August 1998-May 1999 at NAWC China Lake and Point Mugu, CA, onboard USS ABRAHAM LINCOLN CVN 72, USS CONSTELLATION CV 64, and off the coast of Puerto Rico. Eight production representative missiles were launched in 11 attempts against threat representative targets in operationally realistic scenarios. One combined DT/OT shot from a previous test period was included bringing the total number of weapons fired to 9 out of 12 attempts. Based on these test results including weapon boresight and seeker drift errors, poor quality/frozen cockpit video, and excessive multi-path interference, DOT&E was prepared to declare SLAM-ER neither operationally effective nor operationally suitable. The Navy chose to correct the problems discovered during OPEVAL and submit the missile to a new round of tests called the Verification of Correction of Deficiencies (VCD) test phase (OT-IIB).

The SLAM-ER live fire test program began in 1996 and was completed in 1998. Based on data obtained from the lethality tests, DOT&E performed an independent LFT&E assessment on the lethality of the SLAM-ER/WDU-40/B high-explosive warhead. The Director's Live Fire Assessment was completed in FY00, and it was included with the BLRIP Report submitted as a combined document to Congress in May 2000. In the spring 2000, the Navy launched a live SLAM-ER into the

decommissioned CG 19 as part of the surrogate LFT&E program for DD 21. The missile struck the ship and penetrated to the forward magazine. Damage was significant.

## **TEST & EVALUATION ASSESSMENT**

DOT&E monitored the operational testing of SLAM-ER and evaluated the test results. It is DOT&E's assessment that the operational test, which included the VCD phase, was adequate to assess the operational effectiveness and suitability of SLAM-ER.

DOT&E focused on the evaluation of specific effectiveness and suitability parameters. DOT&E independently analyzed the test results addressing weapon system accuracy, IIR seeker and data link performance, weapon effectiveness, weapon system reliability, and operational availability. These areas were chosen because of their relative importance in determining operational effectiveness and operational suitability. Advertised limitations in test conduct did not appreciably affect our ability to assess SLAM-ER performance. LFT&E focused on lethality.

### ***OPERATIONAL EFFECTIVENESS***

SLAM-ER is operationally effective as tested.

- The weapon meets the probability of missile success requirement and the probability of mission success requirement. All four missile launches were successful. A fifth launch attempt failed to arrive at the target because of test range anomalies and was scored as a No Test condition.
- SLAM-ER meets terminal accuracy requirements. The demonstrated circular error probable (CEP) radial miss distance is within the SLAM-ER requirement.
- The weapon boresight problems observed previously have been corrected and no substantial seeker drift errors were observed in the VCD test results. Additionally, the cockpit video quality is much improved with the VCD changes, and the frozen video problem has been minimized. The effects of multi-path interference are also greatly diminished. The result is that target acquisition by the aircrew is greatly enhanced and the crew workload is less.

The SLAM-ER warhead is lethal when accurately delivered against operationally significant targets. When compared to its predecessor SLAM, the SLAM-ER warhead shows mixed improvement in lethality. In its favor, SLAM-ER has double SLAM's penetration capability to attack hardened targets, and its two fuze delay times are twice and four times the SLAM's single delay, which delays SLAM-ER's detonation until the warhead has penetrated deeper within the target. Also, SLAM-ER's fragmentation lethal footprint against such soft targets as missile sites is slightly larger than SLAM. On the other hand, against such targets as buildings and ships that are killed by blast or overpressure, SLAM-ER is potentially less lethal than SLAM because it generates less blast. Nonetheless, SLAM-ER may have greater lethality against a multi-story building than SLAM because its longer fuze delays allow it to penetrate more deeply into the building before detonation, so less blast vents to the outside.

Although not part of the SLAM-ER LFT&E program, in December 1999 the Navy conducted two SLAM-ER warhead events against a decommissioned ship, the CG-19, off Roosevelt Roads Naval Station, PR, to support the DD 21 LFT&E program. The first event was an internal static detonation of a

SLAM-ER warhead to study its blast and fragmentation lethality. The second was a partially fueled, tactical SLAM-ER missile launched from an aircraft targeted at an IR-enhanced area of the ship. Both shots were executed successfully, and they generated significant instrumentation and damage data. A preliminary assessment of the results indicates that the damage inflicted by these two shots is consistent with the DOT&E assessment of SLAM-ER's lethality. In particular, there was no strong evidence that the damage inflicted on the target was enhanced substantially by the reaction of the titanium warhead casing.

### ***OPERATIONAL SUITABILITY***

SLAM-ER is operationally suitable as tested.

- The weapon meets reliability criteria for mean time between operational mission failures.
- It meets the operational availability requirement.
- It meets the Built-In-Test false alarm and probability of correct detection requirements.

### **CONCLUSIONS, RECOMMENDATIONS AND LESSONS LEARNED**

LFT&E test design, conduct, procedures and equipment are deficient in several areas. Live Fire of an all-up-round SLAM-ER on an overland range cannot be conducted due to range safety constraints. Missiles currently have self-destruct mechanisms included in the telemetry (TM) package installed in place of the warhead. As a result, end-to-end testing of overland warhead shots cannot be included in the test strategy. To capture end-to-end performance, testing is accomplished in segments. The results are then collated into a comprehensive evaluation combining the necessary elements of an operational flight. Live shots with TM packages that test launch, cruise, target acquisition, and accuracy are allied with warhead penetration and lethality analysis and testing conducted using the supersonic sled facility at NAWCWPNS China Lake.

The LFT&E used a building block approach to construct a lethality assessment from a variety of technical lethality tests. Although not an original requirement, the lethality assessment would have been more compelling if there had been confirming end-to-end SLAM-ER attacks of actual threat-representative targets using warhead-equipped missiles.

Follow-on testing should be conducted on the automated target acquisition (ATA) modes and are planned for December 2000 and during the early months of 2001. The anti-surface warfare (ASUW) mode will be completed during 3QFY01. Both modes will test the new SEM 1.6 software that will be used in future deployments of this weapon system.